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Bounds on the effective isotropic moduli of thin elastic composite plates

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The main aim of this paper is to estimate the effective moduli of an isotropic elastic composite analyzed within the framework of the Kirchhoff-Love theory of thin plates in bending. Results of calculations provide explicit functional correlations between the homogenized properties of a composite plate made of two isotropic materials, thus yielding more restrictive bounds on pairs of effective moduli than the classical (uncoupled) Hashin–Shtrikman–Walpole ones. Applying the static-geometric analogy of Lurie and Goldenveizer, enables rewriting of these new bounds in the two-dimensional elasticity (plane stress) setting, thus revealing a link to the formulae previously found by Gibiansky and Cherkhaev. Consequently, simple cross-property estimates are proposed for the plate subject to the simultaneous bending and in-plane loads.

Key words: microstructure, inhomogeneous material, plates, optimization, three-dimensional method.

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